Agence spatiale canadienne | Canadian Space Agency

Canada

Earth Observation Express

Other Editions

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1. Ensuring The Safety of Canadians: Hazardous Ice Conditions Information On The Northern Passage Derived From Canadian Earth Observation Satellites

The Canadian ice service provides accurate information about ice in Canada's waters and lands. It contributes to the safety of Canadians, their property and their environment by providing information about hazardous ice conditions in Canadian territorial waters; and provides present and future generations of Canadians with sufficient knowledge about their ice environment to support sound environmental policies. The Viscout Melville channel is an arm of the Arctic Ocean in Kitikmeot, Nunavut, Canada. The channel is part of the Northwest Passage. Forming part of the Parry Channel, it separates Victoria Island and Prince of Wales Island from the Queen Elizabeth Islands. This RADARSAT-2 image of the Viscount Melville Channel from November 1st 2010 captures the contrast of the icy waters (i.e. fast ice, new ice, old ice, open water). This product was developed by the Canadian Ice Service: www.ec.gc.ca/glaces-ice/default.asp?Lang=En&n=0417829C-1&wsdoc=0E80D812-3089-4D90-B5BF-00E1B99346DA.

2. Support to Climate Change Impacts: RADARSAT-2 Glacier Monitoring Service

Through the Canadian Space Agency (CSA) Earth Observation Applications Development Program (EOADP), the Canadian company C-CORE, in cooperation with Natural Resources Canada, has developed new products using RADARSAT-2 to monitor glacier and ice sheet movement and facies change in the Canadian Arctic. The objective of the project, titled "RADARSAT-2 Glacier Monitoring in Support of Climate Change Impact Assessment and Water Resources Management", was to investigate and develop glacier mapping products of velocity and facies over the high Arctic ice caps using RADARSAT-2 data. These activities complemented the work by the Canada Centre for Remote Sensing and Geological Survey of Canada within their State and Evolution of Canada's Glaciers (SECG) program. This project involved the development of two different RADARSAT-2 data products, glacier velocity and facies maps. For glacier velocity flow maps, both DInSAR and speckle tracking were employed to derive output products. The RADARSAT-2 data products were generated over the four following Devon Island glaciers: Sverdrup Glacier; Belcher Glacier; S.

Croker Bay Glacier; and Southeast Glacier. Two principal glacier facies, namely the accumulation and the ablation zones, were easily distinguishable. However, further explanation of the scattering in the transition zone, including that from superimposed ice, would benefit from additional in-situ ice structure data over the radar penetration depth.

3. The MORSE Initiative: Earth Observation Products and Services for Arctic Coastal

Issues such as pollution, climate change, biodiversity, natural resource development, aboriginal peoples, safety and security, and sovereignty have sparked and renewed interest in the Arctic at local, national and international levels. The Canadian Space Agency (CSA) intends to contribute space technologies to address these issues and advance the Government's interests in Arctic coastal regions, in cooperation with other government departments. Imagery acquired from space can be the only means to provide valuable synoptic information of remote regions; furthermore, the imagery can be taken from a range of sensors, each of which is sensitive to different physical phenomena. For example, Canada's RADARSAT-1 & 2 satellites are particularly well equipped to map boundaries between and attributes of ice, snow and water, even through cloud or in darkness. Consequently, the CSA has initiated the MORSE program. It has two critical components: it contributes innovative and much-needed Earth Observation (EO) data for these vast and thinly populated areas, and it supports cooperation and coordination efforts to acquire, share and assimilate EO data among government users and thus enhance surveillance and monitoring tasks as well as scientific work in Arctic coastal regions. Based on a user consultation process, high-priority data, information and service requirements have been identified for: environmental monitoring; mapping; natural resource management and sustainable development; and safety and security. Starting this fiscal year, the CSA Earth Observation Application and Utilizations (EOAU) division supports the following projects through it's Government Related Initiative Program (GRIP): Monitoring Arctic Ocean Process (Fisheries and Oceans Canada); Enhanced Marine Products for the Arctic Coastal Waters (Fisheries and Oceans Canada) and Emergency Spatial Pre-SCAT for Arctic Coastal Ecosystems (eSPACE) (Environment Canada). For more information about MORSE, please visit: www.morse-arctic.net.

4. New Ecosystem Services Management and Stewardship

The ability to quantify ecological attributes resulting from the consumption of "natural capital" has become crucial to our understanding of how this capital can be sustained for future generations. In order to better understand these pressures, ecosystem services allow us to identify, quantify and monitor ecological attributes. Ecosystem services are defined as the benefits obtained from ecosystems, including: (1) provisioning services such as food, water, timber, fibre, and genetic resources; (2) regulating services such as the regulation of climate, floods, disease, and water quality; (3) cultural services such as recreational, aesthetic, and spiritual benefits; (4) supporting services such as soil formation, pollination, and nutrient cycling. Earth Observation (EO) satellite information's are routinely used to identify and monitor land cover and land use, including changes that arise from natural or human activities. Canadian Space Agency (CSA) Government Related Initiatives (GRIP) supported projects, such as Parks Space (Parks Canada, www5.asc-csa.gc.ca/eng/programs/grip/project.asp?Id=139457), Space for Habitat (Environment Canada, www5.asc-csa.gc.ca/eng/programs/grip/project.asp?Id=109084), EcoMonitor (Natural Resources Canada, www.asc-csa.gc.ca/eng/programs/grip/archive_0905.asp) and BioSpace (Natural

Resources Canada, www5.asc-csa.gc.ca/eng/programs/grip/project.asp?Id=114205), are paving the way for natural resource managers to include ecosystem services for their reporting & management activities. The outcomes of these activities are key components of land-based ecosystem services projects that generate credits from sustainable management practices. With the Canadian Government (GoC) committed to fighting climate change through new regulation and a carbon economy on the verge of significant growth, great opportunities are emerging for CSA to participate in land-based ecosystem services projects thereby fulfilling its mandate to use space science and technology to provide both social and economic benefits for Canadians. A consultation workshop with government, NGOs, and private sector stakeholders is planned for early spring 2011. For more information, please contact yves.crevier@asc-csa.gc.ca.

5. 2nd Canadian SMAP Workshop

The Canadian Space Agency has participated to the 2nd Canadian SMAP Workshop on November 16-17 at the Environment Canada (EC) Canadian Meteorological Centre in Dorval. The objectives of the workshop were to provide an overview of the Canadian SMAP on-going and planned activities and to present the Canadian SMAP Science and Applications Plan. The Soil Moisture Active and Passive Mission (SMAP) will provide global measurements of soil moisture and its freeze/thaw state. These measurements will be used to enhance the understanding of processes that link the water, energy and carbon cycles, and to extend the capabilities of weather and climate prediction models. SMAP data will also be used to quantify net carbon flux in boreal landscapes and to develop improved flood prediction and drought monitoring capabilities. Agriculture and Agri-Food Canada, EC, NASA, INRS-ETE, U. of Guelph, U. Sherbrooke, U. of Toronto and U. Waterloo are presently working on the pre-calibration and validation of up-coming SMAP products. All presentations made during the workshop will soon be available on the NASA SMAP web site: smap.jpl.nasa.gov/mission/.

6. RADARSAT-1 Mosaics – now accessible to the general public

For the last 15 years, RADARSAT-1 has observed the Earth from space. Over time, the satellite has generated an impressive collection of images, some of which were used to produce high-resolution mosaics of areas of interest. These were acquired in relatively short time spans and provide a snapshot in time that can be used for studying terrestrial geology, geomorphology, vegetation, coastal features, wetlands, urbanization and ice dynamics. In order to facilitate access to this Earth Observation data, mosaics of Canada, the United States, Africa, Australia and Antarctica are now available to the general public and can downloaded (without restriction) on the CSA web site. These mosaics were produced as part of joint project between the CSA, the Canada Centre for Remote Sensing and MDA Geospatial Services: www.asc-csa.gc.ca/eng/satellites/radarsat1/mosaic.asp.

7. Freshwater: Earth Observation Technologies Applied For the Monitoring of Lake Water Levels

Freshwater is vital for households, agriculture, and industry, and ever larger quantities will be needed for burgeoning human populations over the coming decades. The amount of freshwater available for human consumption and for ecosystem services is affected by many variables. The 20th century was the great age of dam building, which did more to change the face of our planet than

any other single human activity. Lake Mead was established in the early 1930s by the construction of the Hoover Dam on the Colorado River (USA). The Hoover Dam (green area between the lake and river) was one of the first of some 45 000 major dams to be constructed on rivers worldwide. It controls the flow of the Colorado, irrigates farmlands and supplies hydroelectric power and dependable water to people in the southwestern US and northern Mexico. Its reservoir, Lake Mead, is one of the largest in the world, with a surface area of 593 sq km. However, an 11-year drought and increased water consumption due to population growth have resulted in a decline in its water levels. This month, it fell to its lowest point (330 m above sea level) since it was filled 75 years ago. This Envisat image features the manmade Lake Mead, located east of Las Vegas (visible) and west of the Grand Canyon along the border of the US states of Arizona (bottom, east of river) and Nevada (the rest). The Canadian Space Agency has participated to the development of the Envisat Earth Observation satellite. To view the image visit: download.esa.int/images/imageoftheweek/IOW_LakeMead_H1.jpg.

8. eSPACE: emergency Spatial Pre-SCAT for Arctic Coastal Ecosystems

The eSPACE project, developed via the Canadian Space Agency (CSA) Government Related Initiatives Program (GRIP), is part of a new joint initiative from the CSA called MORSE - Arctic Coastal Initiative (www.morsearctic.net/). The initiative focuses on information needs of Arctic coastal ecosystems that can be satisfied by Earth Observation (EO) data from satellites. eSPACE is an multi-agency project to develop and demonstrate the use of EO data for emergency preparedness and response and habitat conservation in Canada's northern coasts. Expected results and outputs of eSpace are: (1) spatially explicit coastal sensitivity and segmentation of shoreline maps for the 3 study sites in northern Canada; (2) improved capacity to use EO resources to support EC's mandate in the Arctic; (3) business case for full implementation of satellite coastal mapping for emergency preparedness and habitat conservation in Canada's north. After the first year of the project, the eSPACE team has reached many important milestones. A kick-off workshop has held in Montreal in May with multiple stakeholders present; many organizations attended and gave presentations on oil spill response, remote sensing and coastal geomorphology. During the summer 2010, two field campaigns were completed; 1600km of coastline was surveyed in James Bay and another 600 km in the in the Mackenzie Delta/Beaufort Sea. The team is currently working on the classification of the shoreline, using the aerial videography and over 100 Radarsat-2 images. The planning for additional acquisitions and field visits for next year is ongoing, with expanded sites in the Northwest Passage, Hudson Bay and northern Labrador. For more information, please contact: Jason.Duffe@ec.gc.ca, Sonia.Laforest@EC.GC.CA or Yves.Crevier@asc-csa.gc.ca.

9. Climate: Use Earth Observation Satellites to Know Your Snow

As well as posing a hazard to communities through transportation shutdowns and floods, snow cover is one of the most important elements influencing the planet's climate, meteorology and water systems. Understanding snow conditions helps us to predict floods and advance climate studies. As winter approaches, northern dwellers will get assistance from space to help them face the harsh weather. Satellite information on snow cover is now available through the GlobSnow project soon after it snows. GlobSnow is also using this state-of-the-art process to generate 30 years of snow data for climate research. For more information, please visit: www.esa.int/esaEO/SEMZ415PVFG_index_0.html.

10. Reducing Loss of Life and Property From Natural Disasters: Haiti Gets Help From the Canadian Space Agency During Floods

On November 5, Hurricane Tomas struck Haiti with strong winds and heavy rains, resulting in wide-spread floods in low-lying areas as well as damage to infrastructure and housing along the western coastal regions of the country. Considering the large number of people still living in tents and camps following the January 2010 earthquake and the present cholera outbreaks, Hurricane Tomas left a major socio-economic impact. RADARSAT-2 data were acquired before and after the event in order to produce change detection maps. Flood-related products were developed by the Canadian company VIASAT GeoTechnologies through a contract with the Canadian Space Agency (CSA) Earth Observation Applications and Utilization (EOAU) division. The products were sent to emergency organizations in Haiti in order to assist local emergency response activities in the wake of Hurricane Tomas. To view the products, please visit: www.disasterscharter.org/web/charter/activation_details?p_r_p_1415474252_assetId=ACT-342. In January 2010, the CSA EOAU division has supported the development of health and disaster management products, including risk estimate maps of the propagation of mosquitoes spreading the dengue fever in the Léogane region: www.asc-csa.gc.ca/eng/programs/grip/archive_100212.asp.

11. CSA response to Hurricane Tomas in the Caribbean

On October 30 and 31, 2010, Hurricane Tomas struck the Caribbean Islands of Barbados, St. Lucia, and St. Vincent and the Grenadines, affecting approximately 1,900 homes, provoking landslides, interrupting water services for over 30,000 people, causing infrastructure damages, as well as electricity and communications disruption. Through the Caribbean Disaster Satellite Pilot Project (CSDP) "Coastal Decision Support With Earth Observation" (CSDP no. 2), a GEO and CEOS initiative, the Canadian Space Agency (CSA) Earth Observation Applications and Utilization (EOAU) division has supported the development and the delivery of rapid flood disaster mapping products for St. Lucia with RADARSAT-2 data. The products were sent to the St. Lucia disaster management organization, the Caribbean Disaster Emergency Management Agency (CDEMA) and to the MapAction NGO to better manage the event in the field. Disaster management products were also developed by the CSDP no. 2 team during Hurricane Earl for British Virgin Island and during Hurricane Nicole for Jamaica. All CSDP no. 2 Hurricane Season 2010 disaster products will soon be available via the CSA web site. For more information, please contact guy.aube@asc-csa.gc.ca.

12. Ice, Icebergs and Glaciation

Through the Canadian Space Agency (CSA) Earth Observation Applications Development Program (EOADP), Noetix Research developed new products using RADARSAT-2 to improve understanding of (i) glacial ice dynamics, (ii) shore-fast sea ice dynamics using InSAR, and (iii) polarimetric SAR for detecting surface fast ice features. The glacial ice dynamics study was motivated by the desire to provide new InSAR methodology which would improve the ability to monitor and understand changes in ice motion and basal drag. The new technique developed in this project provides for the first time accurate measurement of the vertical surface motion even when there are large translational displacements. Measurement of the temporal change in the 3-dimensional movement of the ice surface at the centimeter scale will provide information on the changing conditions at the normally inaccessible glacier bed.

The 3-D glacier motion tracking developed is a first for RADARSAT-2 imagery. These motion results are indicative of the movement of subglacial water and /or a change in basal drag. The new methodology does have application for study of regions in the large ice sheets where there are still important issues concerning changing ice flux and a poorly understood contribution to sea level rise, and how it may change in the future. The ability of RADARSAT-2 to monitor shore-fast ice motion fields has not been demonstrated in the past.The fast ice region appears to be immobile but in realty behaves like a plastic-elastic-viscous material. The results for 24 day repeat InSAR processing of RADARSAT-2 demonstrate that development and deformations within the fast ice can be detected and monitored in cold dry conditions in Canada's Arctic region and in cases where the air temperature rises are below zero during the times of data acquisition but experience above zero temperatures in the interim. The fast ice products have direct application for individuals travelling over the fast ice and scientists/engineers interested in fast ice dynamics. The methods produce maps showing the location of tidal cracks that occur between repeat passes, surface roughness, and an indicator of where the fast ice will break-up.

13. CSA and EC Celebrate Success in Space-Based Monitoring

Environment Canada (EC) and the Canadian Space Agency (CSA) celebrated the success of two collaborative satellite missions at the first joint meeting of the two science teams at EC in Downsview, October 25-27, 2010. Both satellites are carrying Canadian instruments that together are measuring over 60 different atmospheric constituents, including greenhouse gases, air pollutants and ozone-depleting chemicals. The satellites have been making observations many years longer than anticipated and their measurements are providing important reference data for space-based, global atmospheric monitoring. The ACE (Atmospheric Chemistry Experiment) instruments on board the CSA SCISAT-1 satellite were originally launched for a two-year mission but they are now in their eighth year of operation, while OSIRIS (Optical Spectrograph and Infra-Red Imaging System), also on a two-year mission, has been operating on orbit for more than 9 years aboard a Swedish satellite named Odin. The Canadian ACE mission includes two instruments: 1) a Fourier Transform Spectrometer, ACE-FTS, made by ABB BOMEM of Quebec City; and 2) MAESTRO (Measurement of Aerosol Extinction in the Stratosphere and Troposphere Retrieved by Occultation), designed at EC in cooperation with the University of Toronto and manufactured by COMDEV Ltd. OSIRIS consists of a UV-Visible spectrograph and an imaging infrared instrument built by ROUTES AstroEngineering (now COMDEV). ACE measures in occultation mode (watching the sun rise or set through the atmosphere) while OSIRIS, takes measurements of light scattered from the edge of the sky. Both provide high-vertical-resolution information about the composition of the atmosphere from the cloud tops and above. These measurements cover the region of interaction between the troposphere and stratosphere, the stratospheric ozone layer as well as the mesosphere and lower thermosphere. The ACE mission scientist is Peter Bernath from the University of York, UK and U. Waterloo, the ACE Deputy Mission Scientist is Kaley Walker from U. Toronto, the OSIRIS Principal Investigator (PI) is Doug Degenstein of U. Saskatchewan, the OSIRIS Deputy PI is Adam Bourassa from U. Saskatchewan and the MAESTRO PI is Tom McElroy of EC. For information on the OSIRIS instrument and the ACE mission, please visit odin-osiris.usask.ca/, www.ace.uwaterloo.ca/index.html and databace.uwaterloo.ca/acedocs/tiki-index.php?page=ScienceTeamMeeting22 or contact kwalker@atmosp.physics.utoronto.ca.

14. Season's Greetings

The EO Express team wishes you happy holidays and a successful 2011. We hope that you have enjoyed the CSA EO news and events reported in EO-Express in 2010. Your feedback and contributions to eo-express@asc-csa.gc.ca help us keep the EO community better informed.

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